surface of the Laurentian gneiss of western Scotland was anterior to the deposition of the Cambrian sandstones, and that there are minor domes and bosses of crystalline rock, continuous with those of the exposed surfaces supposed to bear the marks of modern glacial action. The conclusion from this would seem to be, that the latter agency has done little more than groove and polish these ancient rounded surfaces, from which a later erosion had removed the covering sandstone. Whether the pre-Cambrian erosion was glacial is a question which Geikie does no more than suggest. In this connection, the existence of a state of chemical decay as a necessary preliminary to the erosion of crystalline rocks should not be lost sight of.[1] We believe that such a process predetermined the contours of their present eroded surfaces.

The question of the erosion of ancient land-surfaces is further discussed by Geikie in a lecture here republished, given by him before the Royal geographical society in 1879, on The geographical evolution of Europe. In this, by aid of the data of geology, he gives a chapter on what has elsewhere been called paleogeography. Geikie shows that the fragment of primeval Europe already noticed, was a part of a great pre-Cambrian area, to which parts of Finland and Scandinavia belonged, and from which was derived the sediments that built up the Cambrian and Silurian series of Great Britain and western Europe. These lower paleozoic rocks in Great Britain alone, he assumes to cover an extent of 60,000 □ miles, with an average thickness of 16,000 feet, or 3 miles, which figures he considers below the mark, — making not less than 180,000 cubic miles, equal to a mountain range from the North Cape to Marseilles, or 1,800 miles long, 3 miles high, and 33 miles wide. This, he well remarks, represents but a fraction of the material thus derived; since in the seas of that time, extending far eastward, were also laid down great thicknesses of paleozoic rocks, continuous with those of the British isles. Calculations of this kind, applied to North America, give us still larger notions of the erosion of great pre-Cambrian areas belonging to some Palae-Atlantis.

It would be profitable, with Geikie's sketches as our guide, to glance at the glaciers of Norway, the ancient volcanoes of Auvergne and of north-western Europe, and to accompany him, in his excursion in 1880, into our western states, where his quick eye readily comprehended many of those remarkable characteristics which make the transcontinental journey from the Atlantic to the Pacific a geographical education.

In his lecture on assuming his late post of professor of geology at Edinburgh, in 1871, Geikie has happily delineated the characters of the Scottish school of geology, and traced many of the characteristics of its masters — Hutton, Playfair, and Sir James Hall — to the local peculiarities of their native land, with its crystalline, contorted, and unfossiliferous rocks, so unlike the regions in which the early Italian school laid the foundations of geology. It is instructive, in this connection, to reflect how the great and simple outlines of American paleozoic stratigraphy, as displayed in the Appalachian basin, led to the grand conceptions of structural geology formulated by the brothers Rogers, by James Hall, and by Lesley, and how the remarkable features of our western regions have taught our geologists of the younger generation lessons which have enabled them so greatly to advance the science, and to correct the views of their predecessors, both in the old and the new world.

We hope on another occasion to notice more in detail some of the questions raised in this instructive volume, in which every student of geology will find something to instruct him, and to stimulate thought.

[1] Harper's annual record of science, etc., 1873, p. xlix.

VERTEBRATE ANATOMY.

A handbook of vertebrate dissection. Part ii. How to dissect a bird. By Prof. H. Newell Martin and Dr. William A. Moale. New York, *Macmillan*, 1883. 4 + [86] p., 3 pl. 12°.

This second part of the handbook is quite up to the standard of the first. It is comprehensive, without going beyond its intended limits; the descriptions are clear and well-worded; the subjects selected for illustration are those most needing it, viz., the more complex parts of the skeleton; and the diagram constituting figure 5 will prove very useful in clarifying certain ideas of the learner.

The method of treatment is well calculated to bring out the observational power of the student; and the fact that the avian, rather than the generic and specific characters, are made prominent, renders the book much more widely useful, and also serves to commend it to practical workers in zoölogy. With the other books of this series, which are to treat in a similar manner of a rat, a bony and cartilaginous fish, and one of the large, tailed amphibia, or Urodela, we shall be supplied with a book which has long been needed in America.

It will be especially welcomed in those laboratories where considerable attention is already given to vertebrate work; and it will do good service in aiding to bring about a more equitable division of time and opportunities in those laboratories where the invertebrates have hitherto received the lion's share of attention, and in some cases have taken nearly, or quite all, the time in a course supposed to be devoted to general zoölogy.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

Attractions. — M. Angelitti discusses the case of the attraction exerted between two masses when the attraction varies as the product of the masses and some function of the distance. The particular function of the distance employed is the inverse *n*th power. The author considers the attraction of lines and plane figures upon a point in the plane, and finally briefly considers the attraction of surfaces and solids upon points external to them. Nearly all of the results are known, many of them having been given by Jellett and Townsend. — (*Giorn. mat.*, xx.) T. C. [584

Bernouilli's numbers. — Mr. Ely, in a paper read before the J. H. U. mathematical society, Jan. 17, 1883, gave an account of the numbers $A_{n,m}$ (generally known as $\Delta^n O^m$) which occur in the proof of Staudt's theorem concerning Bernouilli's numbers. After giving the definition of these numbers in the form of a series, and stating some of their known properties, Mr. Ely proceeds to enunciate a number of new properties. Without using a great many algebraical symbols, it is impossible to give a fuller notice of Mr. Ely's interesting communication. — (*Johns Hopkins univ. circ.*, No. 21, 1883.) T. C. [585

Partitions. — Professor Sylvester defines partition-graphs, and makes certain applications of their properties to infinite series and infinite products, and particularly to the two forms of representation of the theta functions of one variable by means of an infinite series and an infinite product. A partition-graph is defined as a series of points lying in lines parallel to two fixed lines. The number of points, or lines parallel to one of the boundaries chosen at will, will represent the successive components of the partition, and the number of the lines themselves will be the number of parts in the partition. The lines in question are termed *magnitude*-lines, and the crossing ones *part*-lines. The graph is termed regular when the magnitude-lines never increase as they recede from the rectilinear boundary to which they are parallel. This cannot happen without the same being true of lines parallel to the part-boundary. A regular graph is thus one in which the lines and columns of points neither of them increase as they recede from their respective boundaries. A partition is self-conjugate when its representative graph, after an interchange of the names of the part- and magnitude-lines, gives the same reading. Such a graph is therefore symmetrical. By application of the properties of the above-described partitiongraphs, Prof. Sylvester proves the equation between the reciprocal of $(1-ax)(1-ax^2)(1-ax^3)\ldots$ and the infinite series

$$1+\frac{x}{1-x}\cdot\frac{a}{1-ax}+\frac{x^4}{(1-x)(1-x^2)}\cdot\frac{a^2}{(1-ax)(1-ax^2)}+\ldots$$

He also shows how to obtain the development in infinite series of the infinite products $(1+ax)(1+ax^3)(1+ax^5)\ldots$ and $(1+a^{-1}x)(1+a^{-1}x^3)(1+a^{-1}x^5)\ldots$ A parallel bipartition of u is defined as a couple of sets of numbers written on opposite sides of a line of demarcation, so that the number of numbers on the left always exceeds that on the right by a given difference, δ, which may be any number from zero upwards, and such that the sum of all the elements collectively is equal to n. Then the co-efficient of $x^n a^j$ or $x^n a^{-j}$ in the above products is the number of parallel bipartitions of n to the difference j, limited to contain only odd numbers, which must not appear in the same arrangement more than once on the same side of the line of demarcation. In vol. v., No. 3, of the *American journal of mathematics* Prof. Sylvester will give a full account of this new series of partitiongraphs. — (*Johns Hopk. univ. circ.*, No. 21.) T. C. [586

PHYSICS.

(Photography.)

Speed of drop-shutters. — M. Vidal has suggested a method of measuring short exposures. He employs a large clock-face painted black, with white figures, numbering from 1 to 100, painted upon it. A white index-hand is revolved from behind at a uniform speed of one turn per second. Photographs taken of this apparatus themselves register the time of exposure. — (*Brit. journ. phot.*, March 9.) W. H. P. [587

Photographic defects and their remedies. — A short article by Mr. E. H. Farmer gives a list of all the principal photographic defects, together with their remedies. They include gray or metallic, pink, green, yellow, red, and white or opalescent fogs; also frilling, halos, want of density, and spots on the film. — (*Brit. journ. phot.*, March 9.) W. H. P. [588

Notes. — To make plates tropical. Heat them for two hours in a hot oven.

To clean plates. Soak them in hot water, which will dissolve the gelatine.

A convenient plate-lifter. Solder a long, pointed piece of metal to an ordinary thimble. By this means, the plates can readily be lifted from the trays. — (*Phot. times*, Feb.) W. H. P. [589

Electricity.

Efficiency of an electric motor. — Professor S. P. Thompson shows very simply, by means of a graphical method, the laws of work and efficiency of an electromotor, as dependent upon the ratio of its electromotive force to that of the electric supply. — (*Phil. mag.*, Feb.) E. H. H. [590

The electrostatic and electromagnetic systems. — The French have been taking their turn in discussing this matter. MM. Mercadier and Vaschy seek to reconcile the two systems by means of co-efficients depending on dielectric and magnetic inductive capacities. Their arguments and experiments are criticised by M. Maurice Lévy. One who has followed the discussion of this matter, as it has appeared in the *Philosophical magazine* during the